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Studying Variability in the Archaeological Record: An Ethnoarchaeological Model for Distinguishing Mobility Patterns

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³ Fifty percent (21) of the well-dated field houses lie within these catchments, and 21 lie outside the simulated catchments. I interpret this to mean that the predicted catchments delineate the core zone of agriculture around each settlement, with a larger zone surrounding that. Taking into account the number of cells inside and outside the simulated catchments in Period 4, the density of well-dated field houses is 5.8 times higher inside than outside the catchments. Only 27 (35 percent) of the poorly dated field houses lie within the catchments. The density of such sites is, nevertheless, 3.2 times higher inside than outside the catchments. The discussion in this article is limited to field houses within the simulated catchments; outside that area, the assignment of a field house to a particular habitation becomes more problematic.

⁴ There is a methodological point to be made in this analysis. I could have attempted to fit probability distributions to the distances from villages to field houses to characterize their spatial distribution, as done by Preucel (1988:56–63, 234–258). But of course, that procedure assumes that the villages are situated in a uniform plain, and that all locations are equally likely to be chosen for field houses except for their distance. That is clearly not the case here, and it is better to compare the distribution of the actual locations of field houses with our best estimate of the potential distributions for such features, *given the configuration of the local landscape*.

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STUDYING VARIABILITY IN THE ARCHAEOLOGICAL RECORD: AN ETHNOARCHAEOLOGICAL MODEL FOR DISTINGUISHING MOBILITY PATTERNS

Susan Kent

The identification of mobility patterns is important to issues of demography and sociopolitical organization. The ethnoarchaeological model of mobility discussed here attempts to provide relevant indicators of mobility strategies applicable to prehistoric data. The model provides an understanding of site variability at different scales or levels of mobility. It is possible to infer anticipated and actual mobility patterns by applying knowledge of a combination of site size, presence and number of formal storage facilities or their absence, artifact inventories, and diameter of huts. The model is used to distinguish short seasonal occupations from contemporaneous year-round sedentary occupations among five Mesa Verde Pueblo II sites located in the American Southwest. The ethnoarchaeological model provides an alternative approach for examining regional intersite variability.

La identificación de patrones de movilidad es importante para estudios de demografía y organización socio-política. El modelo etnoarqueológico de movilidad que se discute en este artículo intenta ofrecer indicadores relevantes de las estrategias de movilidad que puedan ser aplicados a datos prehistóricos. El modelo permite comprender variabilidad en sitios a diferentes escalas o niveles de movilidad. Es posible inferir patrones de movilidad anticipada y real mediante la aplicación de conocimientos sobre el tamaño de los sitios, la presencia y cantidad de estructuras formales de almacenaje, inventarios de artefactos y el diámetro de las viviendas. El modelo es utilizado para distinguir ocupaciones estacionales breves de ocupaciones sedentarias de tiempo completo contemporáneas en cinco sitios Pueblo II de Mesa Verde, en el suroeste de los Estados Unidos. El modelo etnoarqueológico ofrece un enfoque alternativo para analizar la variabilidad regional entre sitios.

It is important for archaeologists to understand regional site variation. I suggest that some site variability is the result of variability at two levels of mobility patterns. On the cross-cultural level, wherein differences between societies are contrasted, types of mobility patterns are often classified together as either nomadic or sedentary (e.g., Eder 1984). The various types of cross-cultural mobility patterns impact differently on a society's site structure, political and social organization, and other

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aspects of culture and behavior in archaeologically recognizable ways (Kent 1989a, 1990; also see Beardsley et al. [1956:129–157] for an early discussion of the impact of mobility patterns).

Binford's (1980, 1982) distinction between nomadic foragers and nomadic collectors is an example of the cross-cultural variability between groups that are both categorized as nomadic. Another example is the !Kung forager pattern that has been referred to as "tethered nomadism" (Binford 1980; Kent and Lee 1992). The !Kung tend to spend several consecutive months at a pan with permanent water during the dry season and then move every few days or few weeks during the rainy season. This pattern contrasts with the mobility patterns of Central Kalahari G/wi or of tropical nomadic foragers.

There also are different types of sedentism. Interwoven sedentism refers to a pattern in which a group is sedentary for a number of years, then nomadic or semisedentary for several years, and then sedentary again, a pattern found among some Amazonian societies (e.g., see Vickers 1989). In contrast, short-term sedentism occurs when people reside at a location for more than 6–10 months at a time but less than 20–40 years. Hypersedentism describes a society that remains sedentary for centuries.

Examples of all of the above types of cross-cultural mobility patterns can be found in the ethnographic literature, and they probably also occurred in the past. Each impacts the archaeological record in a different way that is important to delineate. Within each category on the cross-cultural level of mobility, e.g., short-term sedentism, there is another dimension of mobility that is equally important to recognize and that occurs on an intragroup, or within-group, level. This intragroup level of mobility patterning is what I have referred to elsewhere as "anticipated short," "medium," or "long" mobility.¹ In other words, there are varying lengths of occupation, or camp duration, among societies classified as having a particular type of nomadism or sedentism. As with cross-cultural mobility patterns, different intragroup mobility patterns have been observed ethnographically and also probably were present in the past.

Intragroup, or within-group, mobility patterning, in contrast to cross-cultural mobility patterning, encompasses the dimension of length of site habitation, be it anticipated or actual. The model presented below links site variability to different mobility patterns on the intragroup level. It does so by taking into account the fact that people can plan to occupy a camp for different amounts of time. I refer to these different amounts of time as anticipated short, medium, or long intragroup mobility, within the context of categories of nomadism and sedentism (see Note 1). Whereas most nomadic societies will tend to have shorter habitations than sedentary societies, within each mobility strategy there is a range of patterning. For example, among nomadic Basarwa ("Bushmen," San) many groups traditionally spend two to three months at a pan during one season, then eight to 10 months in a number of different camps scattered across the landscape (Kent [1992a] discusses differences in Basarwa mobility patterns). Therefore, nomadic Basarwa can have anticipated longer and shorter occupations and still be categorized as nomadic, as their longer occupations are relatively short compared to those of sedentary groups.

We should then expect variability in mobility patterns and, concomitantly, variability in site structure, on two separate but related levels. General terms as "nomadic" and "sedentary" are applicable on the cross-cultural level (referred to as "permanence" by some) and terms such as "anticipated short," "medium," or "long" occupation are applicable on the intragroup level (referred to as "duration" by some, e.g., Ames [1991]). It is proposed that the following model of mobility applies to both the intergroup and intragroup levels, with the qualification that each should be measured on a different scale (e.g., what might be considered a short period of time to a sedentary society may be a long period to a nomadic one).

There is much literature that discusses different methods of classifying the movement of people across the landscape and suggests which terms are most appropriate for that classification (e.g., Ames 1991; Beardsley et al. 1956; Binford 1980, 1990; Cribb 1991; Dohm 1988; Eder 1984; Ingold 1987; Plog et al. 1988; Preucel 1991; Rafferty 1984). Eventually, all archaeologists may adopt a practical typology of mobility patterns—one for the intergroup level and one for the intragroup level. Meanwhile, in an attempt to understand variation rather than to produce the ideal typology, I use the terms for the different types of nomadism–sedentism to designate cross-cultural mobility

patterns. I use the terms duration or short, medium, and long occupation for intragroup patterns, as in, for example, an anticipated short occupation.

It is important to distinguish variability resulting from different mobility patterns on both levels from that caused by other factors. Different interpretations may be more appropriate for short seasonally occupied sites than for residential sites occupied year-round, as noted by Binford (1978: 495–497). Habitations of a long or medium length in a nomadic society may be qualitatively and quantitatively different than those in a sedentary society. Specific facets of site structure, such as the partitioning of space, have been attributed to various mobility patterns (Kent 1991a, 1991b). Therefore, it is critical to refine our methods to be able to identify patterns of mobility in the archaeological record.

The model introduced below differentiates between occupations of short duration and long duration. Such variability within regional mobility patterns is now being incorporated into models of past settlement patterns (e.g., see Johnson 1989; F. Plog 1989). It is generally recognized that in sedentary groups, for instance, special seasonal-activity sites are often briefly occupied in order to procure resources that are transported to a base camp. In fact, one might expect to find more limited activity sites used by short- and long-term sedentary groups than by groups who follow other mobility patterns. Population estimates based on the number of sites in a region need to take this into account (Dohm 1988; Powell 1988).

Although this discussion is not about Anasazi prehistory *per se*, the model is applied to the excellent data base from the Pueblo II period in the Mesa Verde region to test its utility for understanding intersite variability. Recently, archaeologists have grappled with identifying mobility patterns in the American Southwest because of the importance of such patterns for interpreting demography and sociopolitical organization (e.g., Schlanger 1988; Upham 1988; also see Cordell 1984, 1989). The following model represents a beginning for understanding intragroup variability in site structure. The first step is to examine different mobility strategies, both anticipated and unanticipated, within the archaeological record. Here I attempt to delineate two of these intragroup patterns—short-term and long-term occupations—in the Anasazi Southwest, using an ethnoarchaeologically derived model. The data base is not my intended focus; more important is the understanding of variability in the archaeological record through the use of an ethnoarchaeological model.

THE ETHNOARCHAEOLOGICAL MODEL

The model of the influence of mobility has been detailed elsewhere and therefore will only be summarized here (Kent 1991a; Kent and Vierich 1989). It was hypothesized that anticipated mobility—the length of time that people plan to occupy a camp—is a significant and strong predictor of site size, number and size of huts, number of features, and the presence of formal storage facilities, such as slab- or clay-lined pits (analogous to Binford's [1977, 1987] concept of planning depth but pertaining specifically to mobility). For example, I hypothesized that the presence of formal storage facilities, such as platforms or pits (in contrast to informal storage areas, such as the roof of a hut or trees in which objects are placed), is the result of the accumulation of goods based on anticipated restricted mobility. According to this perspective, formal storage is not based on economic pursuits, actual length of occupation, season of habitation, or other variables commonly assumed to influence its presence.² I further hypothesized that people who anticipate a short occupation will not construct elaborate dwellings of energetically demanding construction styles or materials. Neither will they use formal refuse loci, such as discrete middens. Because I proposed that anticipated mobility is the strongest predictor of site size, presence of formal storage facilities, and hut size, etc., I needed to compare anticipated length of occupation with those factors traditionally thought to explain the most variance in the predicted variables. The independent variables chosen to monitor were the actual length a site was occupied (e.g., the longer the occupation, the larger the site), site population, season of occupation, subsistence orientation, and ethnicity. A model including these hypothesized relations was applied to data collected by Helga Vierich among the Basarwa ("Bushmen," San) and Bakgalagadi (Bantu speakers) of the Kalahari Desert, Botswana (Kent and Vierich 1989).

I was interested in the effect of elapsed time on site structure or what I call actual mobility. Actual

length of occupation has been used as an independent variable to explain various properties of site structure and artifact accumulation. For example, Yellen (1977:129), in a classic study of !Kung spatial patterning, suggests that the size of the outer ring of a camp (absolute limit of scatter of all camp debris [ALS] or limit, or extent, of most scatter [LMS] [Yellen 1977:103])—i.e., total site size—reflects the length of occupation. In other words, according to Yellen's data, time is a significant variable in influencing the dependent variables I was examining. LMS usually corresponds to the site-size measurements made by Vierich at Ngware³ and by myself at Kutse. On the basis of LMS "one can enter an abandoned !Kung camp, take a few measurements, and estimate the length of occupation" (Yellen 1977:130). If that is in fact the case, then one of the most important considerations for understanding disparity in site size is how long a site was inhabited at the point of the investigation and/or abandonment. According to Yellen (1977) and others there should be a time-dependent growth in the size of camps based on elapsed time that is visible if one visits a camp after one week, two weeks, three months, or six months of occupation—i.e., an incremental build-up of cultural materials, site size, square meters per person, etc.

Due to postabandonment processes, some of which are partially conditioned by different lengths of abandonment, sites unoccupied for varying amounts of time might bias visibility and measurement of the various dependent variables. That is, variability in the dependent variable could simply result from differential preservation due to different lengths of site abandonment.⁴ To control for such potential inconsistencies in the data, and to hold preservation, abandonment, and visibility constant, I decided to include only those camps still occupied or, at most, only very recently abandoned. I reasoned that if the dependent variables were influenced by the length of time a site was occupied, then it should not matter whether or not a site was still occupied at the time of determining its actual length of habitation. The problem in trying to test occupation duration and the dependent variables through the use of only abandoned camps is the inability to control for variation resulting from different lengths of abandonment, mode of abandonment, postabandonment scavenging, curation, etc. (see Schiffer [1987], for example). Although perhaps not the perfect solution, I calculated actual length of occupation in such a way as to factor out abandonment and preservation as variation in order to look exclusively at actual duration as an independent variable by itself.

The model was tested with 31 camps that had been mapped, analyzed, and their occupants interviewed by Helga Vierich (Kent and Vierich 1989). Length of anticipated occupation at the time of establishing the camp was contrasted with the actual length of habitation at the time of mapping the camp (i.e., point of mapping minus date of first occupation). Actual length of habitation was grouped into three categories because of difficulty in determining the precise day of initial occupation. These are: short (less than three months), medium (three to six months), and long (over six months).

Independent variables other than anticipated mobility that were tested in the model included the number of site occupants (range 2–40 persons), season of occupation (dry season, wet season, or year-round), subsistence orientation (whether occupants were primarily hunter–gatherers, farmers, employed, or followed a mixed strategy), ethnic affiliation (Basarwa or Bakgalagadi), and actual length of habitation at the time the camp was mapped. These factors represent some of the major variables often thought to influence site structure.

Statistical Analysis of the Ethnoarchaeological Data

Noncontinuous independent variables were converted into dichotomous dummy variables. As a consequence of the small sample size ($n = 31$), a bivariate regression was run (see Kent and Vierich 1989).⁵ Because it is important to understand how R^2 is calculated, interpreted, and how much explained variance is appropriate to expect with social science data, and since there is some confusion concerning these issues, a discussion of R^2 as it is being used in this analysis is presented in Note 5. A bivariate-regression analysis of Vierich's data revealed that the relations among anticipated mobility and facets of site structure and site size were consistent and transcended ethnicity and subsistence strategy.

In order to determine the strength of each independent variable and to provide a multivariate

comparison, the spread (i.e., a measure of the strength of the predictor variable) was calculated (Kent 1991a). The spread measures the effect of each of the independent variables on the dependent variables monitored, such as site size, number of huts per camp, etc. Dummy variables were constructed to represent each level of the variables. For example, anticipated mobility was divided into three dummy variables of short, medium, and long. Each dummy variable or level predicts a particular site size ($\hat{Y}$) in the regression equation by virtue of its regression coefficient. The spread measures the size of sites predicted by the dummy variable representing long anticipated mobility minus the site size predicted by short anticipated mobility, that is, the highest level of a variable minus the lowest level. Thus, for anticipated mobility, moving from short to long increases the estimated size of sites (the parameter estimate or *b* weight) by 43.907 square meters per person, whereas actual mobility only increases it by 26.276 square meters per person, subsistence orientation by 21.678 square meters per person, and site population by 1.638 square meters per person (Table 1).⁶ In other words, the larger the spread, the stronger the predictor variable. Anticipated mobility is the strongest predictor of square meters per person.

Succinctly, Vierich's data and my research at Kutse indicate that anticipated length of occupation (or anticipated mobility in Table 1)—that is, how long inhabitants anticipate/plan to occupy a site—is a stronger predictor of site size, square meters per person, and the diameter of huts than are the other variables tested, including actual length of camp occupation, economic orientation, ethnicity, and season of habitation (see Table 1). The presence/absence of formal storage loci also is dependent on how long inhabitants plan to reside at a camp (Kent 1992b). People planning to stay for a short period of time do not construct formal storage facilities, regardless how long they actually occupy a camp. The actual number of formal storage areas is significantly correlated with anticipated mobility, which is the strongest predictor of the number of such loci, although the strength of the relation is similar to that for the number of formal storage areas and ethnicity. There is an important distinction between informal and formal storage. Informal storage occurs at most, if not all, sites. In contrast, the presence/absence of formal storage facilities (e.g., granaries, lined storage pits) is correlated with anticipated length of occupation. No formal storage facilities are present at anticipated short occupations in this data base, regardless of how long the actual occupation is and at least a few facilities are often constructed when people first set up camp (i.e., when actual mobility is short [Kent and Vierich 1989:Table 9.9]).

This association between presence/absence of storage facilities appears to be cross-culturally valid. For example, on the cross-cultural level of the model, it is predicted that formal storage occurs primarily in groups that can be classified as semisedentary or sedentary. A cursory view of the literature supports the model's prediction. Formal storage facilities can be found at semisedentary and sedentary hunter-gatherer camps in societies as diverse as the Basarwa, Nunamiut (Binford 1978), and Northwest Coast Indians (e.g., Croes 1977), in addition to sedentary horticultural groups. Formal storage facilities do not occur at nomadic Pygmy or Basarwa hunter-gatherer camps (Fisher 1986; Kent 1992b). I attribute this association to the consequence of sedentism that results in an accumulation of objects that is separate from a group's mode of production (Kent 1992b). However, if reoccupation of a site is planned, such as in the case of a seasonal camp located adjacent to a horticulturist's fields (or perhaps a cache at a semisedentary forager's camp at which reoccupation is planned), storage facilities may be present. In fact, it appears that planned reoccupation might result in a site structure that is otherwise associated with a longer anticipated occupation, although this is a possibility that needs to be explored in depth on a cross-cultural level. It could, however, explain the presence of formal storage pits at what are traditionally interpreted as seasonal Anasazi field camps.

On the cross-cultural level, data from a variety of societies suggest that site population influences the number of habitation structures at a site but does not determine their size, which is instead influenced by anticipated mobility (Kent and Vierich 1989). It appears that structures are larger when occupants anticipate a long rather than a short habitation, regardless of the number of people living in the dwellings. Table 1 shows that anticipated mobility increases the estimated diameter of huts by .719 m, whereas actual mobility only increases it by .417 m. Season of occupation increases hut size by .360 (range = 1.9–5.7 m). Fisher and Strickland (1989) also report that hut

Table 1. Bivariate Regression Analysis.

Dependent Variable	R^2	$p > F^a$	Spread ^b
Square meters per person			
Anticipated mobility	.5093	.0001	43.907
Number of site occupants	.3201	.0014	26.276
Subsistence orientation	.3085	.0244	21.678
Actual mobility	.2390	.0287	1.638
Ethnic affiliation	N.A. ^c	.0585	N.A.
Season of occupation	N.A.	.3014	N.A.
Site size			
Anticipated mobility	.2458	.0255	1,125.203
Number of site occupants	.1778	.0227	42.593
Actual mobility	N.A.	.0706	N.A.
Subsistence strategy	N.A.	.2973	N.A.
Season of occupation	N.A.	.4844	N.A.
Ethnic affiliation	N.A.	.6956	N.A.
Formal storage facilities			
Anticipated mobility	.2340	.0313	1.405
Ethnic affiliation	.2324	.0081	1.311
Subsistence strategy	N.A.	.1541	N.A.
Number of site occupants	N.A.	.1969	N.A.
Actual mobility	N.A.	.2300	N.A.
Season of occupation	N.A.	.6988	N.A.
Hut diameter			
Anticipated mobility	.3788	.0020	.719
Actual mobility	.2773	.0147	.417
Season of occupation	.1906	.0179	.360
Subsistence orientation	N.A.	.0781	N.A.
Number of site occupants	N.A.	.2081	N.A.
Ethnic affiliation	N.A.	.6932	N.A.
Number of huts			
Number of site occupants	.3844	.0003	N.A.
Season of occupation	N.A.	.4948	N.A.
Subsistence orientation	N.A.	.7923	N.A.
Actual mobility	N.A.	.9304	N.A.
Anticipated mobility	N.A.	.9909	N.A.
Ethnic affiliation	N.A.	.9522	N.A.

Note: Data from Kent (1991a).

^a The $p > F$ value should only be used as a guide to measure the significance of the association because of the nature of the sample. Nominal variables were transformed into dummy variables for the regression.

^b A measurement of the strength of the predictor variable, calculated by taking the predicted values for each dependent variable ($\hat{Y}$) and subtracting the low from the high predicted value for each set of dummy variables (or the range). Nonsignificant bivariate relations are not included because the sample size necessitated a minimum number of predictor variables in order to increase the power of the test.

^c N.A. = nonapplicable since the association is not significant.

diameter is not significantly associated with the number of inhabitants at the .05 level. Population seems to influence the number of huts built at a camp, as well as windbreaks, but does not influence their size. This is the case among the Pygmies and Navajos, as well as the Basarwa and Bakgalagadi (Fisher 1986; Kelley 1982; Kent 1991a). Note that Hayden and Cannon (1984) also found a lack of correlation between floor area and household population at a Mayan village and that Wilk (1983) found a significant correlation between dwelling area and length of occupation at Mayan villages. I suggest the reason for the correlation between larger dwelling size and anticipated mobility is the

tendency of people who plan to occupy a camp for a longer period of time to have more cultural materials. They therefore build larger abodes. Whatever the ultimate reason for the correlation, a relation exists between the two variables on both levels of analysis.

Furthermore, refuse at anticipated medium- and long-term habitations tends to be disposed of at formal loci more often than at short-term sites, perhaps because occupants usually assume that actual and anticipated duration will coincide and that lengthier stays will produce more trash to discard. For example, nomadic !Kung Basarwa camps generally lack formal middens, and refuse is basically deposited as sheet trash across the site (Yellen 1977). In contrast, refuse dumps are present at sedentary Basarwa camps located in the northeastern and east-central parts of the Kalahari (Bartram et al. 1991:98; Hitchcock 1987:406, 416). Trash at short-term occupations often is dispersed along the margins of the camps.⁷ Even more enlightening is a camp where inhabitants only stayed a few weeks but had intended to stay a long time. Refuse was discarded at a midden despite the camp's actual short occupation. In other words, regardless of the actual length of stay, the inhabitants planned for a long occupation and deposited refuse at a midden from the onset (anticipated rather than actual duration determined the use of a midden in this case). In the converse situation, refuse was more scattered about a camp where occupants planned to stay a short period of time but ended up staying for a long time (Kent and Vierich 1989).

Thus, with the exception of the number of huts, anticipated mobility appears to be the strongest predictor of various facets of site structure. This is particularly important because it means that mobility patterns are discernible from the archaeological record and are *not* tied to an individual culture, as are most ethnic-specific patterns that are difficult to identify with archaeological data (e.g., Hodder 1987). Instead, the ethnoarchaeological model described here appears to be valid on the cross-cultural level in diverse groups from Basarwa and Pygmies to Navajo Indians (Kent 1991a; Kent and Vierich 1989). For example, the significant correlation between length of time inhabitants anticipate to stay at a site and facets of site structure, such as the amount of energy they are willing to expend on site construction, is cross-culturally consistent (i.e., the permanence of architecture, size of dwellings, and site size, regardless if measured in terms of square meters per person or in absolute size). Because of this cross-cultural validity, the model is not tied to one specific ethnic group at one point in time. Instead, the model can be applied to different cultures in the archaeological record and used to reinterpret existing data in new ways.

On-going research at Kutse, a different Kalahari community than the one used initially to test the proposed relations, further supports the theoretical model (Kent 1992a, 1992b). Material analyzed thus far indicates that anticipated mobility accounts for more variance in the amount of cultural materials recovered at features than other independent variables tested, with the exception of "type," or whether a camp is occupied or abandoned (Kent 1993). Type has a significant statistical correlation and explains the most variance in the abundance of cultural materials in features located at 46 sites from Kutse. More interesting, and for less obvious reasons, anticipated length of occupation is the only other independent variable that is significantly correlated with assemblage abundance at features for reasons explored in Kent (1993).⁸

Basically, and somewhat counterintuitively, it appears that the principle that individuals who anticipate a longer occupation will bring more objects to the camp explains more variance in artifact quantity than does the well-known assumption that, under noncatastrophic abandonment circumstances, the longer a camp is occupied, the more objects are deposited (e.g., Schiffer 1987). In other words, people who plan to stay a short time will bring less objects to a site than those who plan to stay a long time (wealth is factored out as a potential confounding variable at Kutse). A bivariate regression reveals that the actual length of time a site was occupied is almost significant ($p = .0557$), explaining only 12.6 percent of the variance. However, because of shared variation with anticipated mobility and type, actual mobility is not significant in a multivariate model ($p = .3608$; Kent 1993). In contrast, anticipated mobility is significant in both the bivariate and multivariate models ($p < .05$). Moreover, adding actual mobility to the multivariate model did not significantly increase the R^2 , whereas adding anticipated mobility to the model did significantly increase it ($p = .0031$; Kent 1993).

The different amounts of cultural materials result from the strategies concerning artifact organi-

zation that are associated with the different anticipated lengths of occupation, which I suggest is the case on either the cross-cultural or intragroup level. For instance, on the intragroup level, people who anticipate short occupations among sedentary societies may have fewer objects because they take fewer possessions with them if they plan to stay at a special-activity site for only a brief period (i.e., they cache their objects at the base camp). The Basarwa data indicate that nomadic societies not only have fewer possessions in general than sedentary societies, but that people who plan short occupations have the fewest number of objects within the range that is characteristic of nomadic groups (Kent 1993). Different lines of research also indicate that the longer the occupation, the more diverse or variable the material culture (Reid 1982; Schiffer 1976; Schlanger 1990; Whittlesey and Reid 1982; Yellen 1977).

As the preceding examples show, the relation between anticipated length of occupation and site characteristics remains constant even in those cases where the planned length of habitation does not conform to the actual length of occupation; that is, anticipated occupation is a stronger predictor and explains more variance than actual length of occupation. When anticipated plans fail, there is dissonance between the model's predictions and the archaeological record that is visible to the archaeologist. A good example is the Basarwa camp where the residents built three storage platforms and used a formal midden in anticipation of a long occupation, though the camp was abandoned after only three weeks (Site 31 in Kent and Vierich [1989]). This and similar camps can be contrasted with other sites at which inhabitants anticipated a short occupation but stayed a long time. At one such camp, no formal storage facilities were constructed or formal middens used (Camp 2 in Kent and Vierich [1989]). We can see that in these examples, the presence of formal storage facilities and formal refuse loci was conditioned more by how long inhabitants planned to stay than how long they actually did. In most cases, anticipated and actual coincide, for people do not continue to plan for situations that never occur. However, even the best-laid plans sometimes do not materialize. It is suggested below that Pinyon House, a mid-Pueblo II site, is one such example.

Whereas what constitutes a long occupation vs. a short occupation may vary from group to group, particularly between those with very different mobility patterns (i.e., what is short to a sedentary group may not be short to a nomadic group), the general principle remains the same on both levels of analysis. Although regional patterns can be predicted using the ethnoarchaeological model of site structure and mobility, the categories may not apply in the same way to regions of constrained space and/or to cities/towns. However, work conducted by Wilk (1983) among the Maya indicates it might. More research is necessary for those contexts. The model presents several robust relations that can be used to distinguish mobility in the archaeological record, as is demonstrated below. Only the long and short categories are examined because the archaeology of Mesa Verde Pueblo II sites is not particularly well understood and because of the differences in excavation, analysis, and reporting of the specific sites. "Short" is used to designate seasonal occupations and "long" refers to year-round occupations.

APPLICATION TO THE ARCHAEOLOGICAL RECORD: GNATSVILLE

Mesa Verde Pueblo II sites are generally small, dispersed camps rather than the large villages characteristic of earlier and later periods in the region. The model is therefore applicable to the Pueblo II period, but research is needed to determine its utility for other time periods when large contiguous apartment-like structures were inhabited. The sites used in this application of the ethnoarchaeological model are five Pueblo II occupations located in southwestern Colorado (Figure 1).

Extrapolation of relations based on camps that are built around two to six huts and/or windbreaks (the ethnoarchaeological model) to camps built around a kiva and two to six rooms (the archaeological sites) might present a potential source of difficulty. One might argue that the relations between mobility and size and number of rooms and between size and number of huts are not directly comparable. Certainly information collected from large aggregated pueblos, such as those at the Hopi Mesas or Zuni, would be inappropriate for a model of small mid-Pueblo II Mesa Verde Anasazi sites, just as the ethnoarchaeological camps used in the model here would not be appropriate for the study of large Pueblo III multiple-room town sites but are, I suggest, appropriate for the

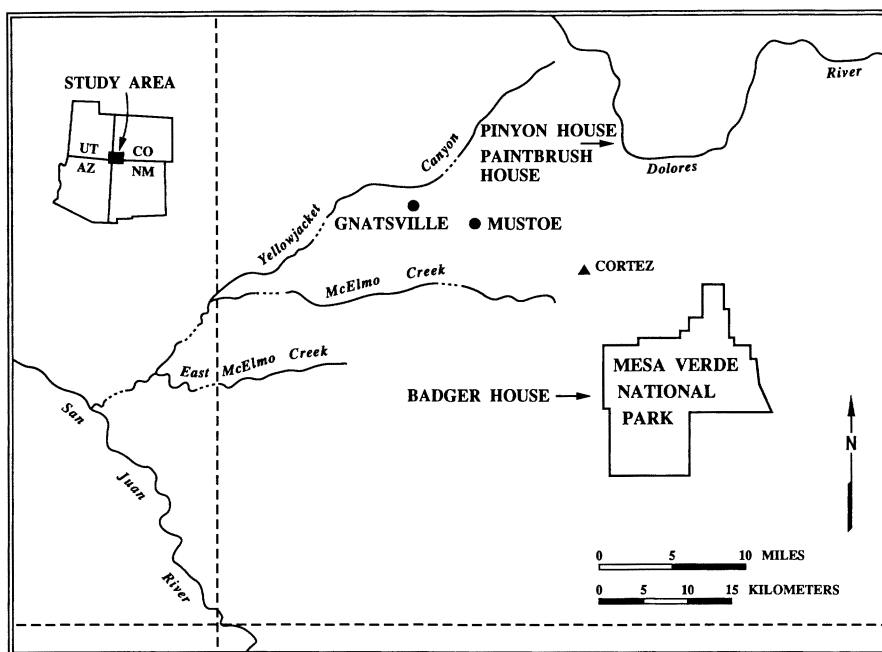


Figure 1. Map of sites mentioned in the text.

study of the Pueblo II sites. However, it is for this reason that the specific number and size of rooms are not discussed below. For now we are constrained to use gross categories such as overall site size until more ethnoarchaeological data become available that detail these relations in a variety of settings in seasonal and year-round camps with huts and with room blocks similar to those of Pueblo II (research of this type is currently being explored, e.g., Graham [1989]). With these caveats in mind, it is possible to apply the model to archaeological data in order to understand regional site variation and to elucidate mobility patterning among mid-Pueblo II Anasazi.

The sites chosen for study were selected because they are located within a regional setting and are more or less contemporaneous. In addition, ceramics, lithics, faunal, and botanical remains from three of the sites were analyzed using the same Dolores-Archaeological-Project-trained analysts, methods, and nomenclature, thereby enhancing their comparability. Although none of the sites described below may be perfect for the application of the mobility model, together they provide a good example of how one can go about applying the model to archaeological data.⁹

Gnatsville (5MT1786) is the test site used for comparisons with the other sites. The site consists of a Pueblo II rubble mound, a kiva, two middens, and a large bell-shaped pit (Kent 1991c). Gnatsville is a small, primarily single habitation that is securely dated between A.D. 1030 and 1050 (Kent 1986).¹⁰ The tree-ring and archaeomagnetic dates are consistent with the dates from ceramic, projectile point, and architectural seriations. All dating techniques indicate a short single occupation. Data from objects located throughout the middens, kiva, rubble mound, and areas in between are consistent with the interpretation of a single occupation (i.e., surface, fill, and floor assemblages were the same). The area around an intrusive clay-lined hearth only contained lithic artifacts, with the exception of one sherd obviously displaced from the rubble mound. The hearth represents a discrete, limited activity area that does not affect this analysis.

The kiva at Gnatsville has a prepared floor composed of soil that is exotic to the immediate site area. Its roof was burned, which is not an uncommon occurrence for kivas in this area (e.g., Kuckelman 1984). The lithic raw material and ceramic-tempering material both indicate that the inhabitants used local materials and had little exchange with neighboring Anasazi groups. Faunal remains show that the occupants were hunting large, medium, and small wild animals, as well as

consuming domesticated turkey and, occasionally, dog. Micro- and macrobotanical remains reveal an extensive use of maize and a wide range of wild plants. Thus, the inhabitants employed a mixed subsistence strategy involving domesticated and wild plants and animals (Kent 1991c). Excluding those micro- and macrobotanical remains from foods that were probably stored, such as maize and beeweed, pollen and flotation samples collected at Gnatsville include a variety of species with overlapping flowering periods ranging from May through September (one would not expect pollen representing winter in this area). The faunal-remains inventory contains both mature and immature specimens of the same species, as well as eggshell. Taken together, the data suggest a multiseasonal occupation, in contrast to repeated seasonal occupations. This supports the contention that Gnatsville represents a year-round sedentary occupation and not a seasonal field house. The advantages of using Gnatsville as the base site in this study are its consistent dates established through a variety of methods—dendrochronology, archaeomagnetic dating, and seriation—and its primarily single component spanning only ca. 20 years. As a consequence of the short, primarily single-component nature of the site (the clay-lined hearth area was discrete from the rest of the site), the artifact inventory lacks the problem of assemblage mixing from different components.

YEAR-ROUND VS. SEASONAL: REGIONAL COMPARISONS

Four sites are chosen for comparisons with Gnatsville. Two are the only single-component mid-Pueblo II sites excavated by the Dolores Archaeological Project (Kane and Gross 1986; Note 9). Paintbrush House and Pinyon House are both located along the Dolores River (Kleidon 1984; Kuckelman 1984). The third, the Mustoe site, is part of the Goodman Point archaeological area (Gould 1982) and the fourth, Badger House, is located at Mesa Verde National Park (Hayes and Lancaster 1975). These sites were selected because of their proximity to each other (see Figure 1), their roughly contemporaneous occupation (mid-Pueblo II, specifically ca. A.D. 1000–1050), and their detailed architectural and artifact analyses that permit cross-site comparisons. Ceramic seriation and, where available, archaeomagnetic and dendrochronologic dates were used to establish the contemporaneity of the five sites. Nevertheless, some caution needs to be exercised whenever comparing sites excavated almost 20 years apart by different projects with their own excavation strategies and research goals. Another recognized complication is that Mustoe and Badger House are multicomponent; this creates the potential of artifact mixing between components.

Pinyon House and Paintbrush House were interpreted by their excavators to be short seasonal occupations (Kleidon 1984; Kuckelman 1984). Below I use the ethnoarchaeological model of mobility to suggest that Mustoe, Badger House, and Gnatsville represent anticipated and actual long occupations, Paintbrush House represents an anticipated and actual short occupation (e.g., field house or other special activity), and Pinyon House represents an anticipated long but actual short occupation. Pinyon House and Paintbrush House are particularly important to this discussion because of their obvious differences (discussed below); for this reason they represent the variability among sites that we as anthropologists seek to investigate. These sites only appear to be anomalous until they are viewed within the context of the mobility model.

Site Size

The size of a site can be computed several ways. Size was determined here by measuring the absolute extent of the site as inferred from the distribution of surface artifacts/features, i.e., total site size (see Dohm 1988) or LMS (Yellen 1977:103), and by calculating the number of individuals per square meter. The latter is actually a measurement of site size and of site population density. Site size, or the total site area, and square meters per person measurements are highly correlated with length of anticipated occupation. Archaeologically, site size translates into the extent of the artifact scatter and feature distribution at an occupation. Various formation processes identified by Schiffer (1987) will condition this distribution to some extent. However, there is nothing in the site reports to indicate that the processes differ significantly at the sites being compared; therefore such processes can be held constant in the comparisons. Based on the extent of the artifact scatter and consistent with the mobility patterns proposed for each site, Paintbrush House is substantially

smaller in total site size than any of the other sites. Precise site measurements are available only for Gnatsville (3,600 square meters), Pinyon House (45,000 square meters), and Paintbrush House (1,008 square meters). Even taking into account the inherent fuzziness of site boundaries and potential variation in how people determine such boundaries through surface artifact densities, Paintbrush House covers less area than any of the other sites. It is interesting to note that the rubble mounds at Gnatsville and Pinyon House are roughly the same size as the rubble mound at the Mustoe Site (all are about 80 square meters). This is consistent with the interpretation of Pinyon House as an anticipated long occupation.

Architecture and Site Structure

Gnatsville consists of a room block, kiva, and midden. Walls are what Rohn (1977) refers to as “megalithic” in style. The Pueblo II component of the Mustoe site, with several rooms and a kiva, is very similar to Gnatsville. Badger House is a complicated set of houses and kivas, many superimposed by Pueblo III features. However, one kiva and room block are associated with the mid-Pueblo II period, which makes this part of the site comparable to the other sites (see Hayes and Lancaster 1975:Figure 239). Pinyon House consists of a room block and kiva (Kuckelman 1984). Paintbrush House consists of only a kiva, although the excavators suggest that a room block may be located in the nonsampled portion of the site that actually contained the highest density of surface artifacts (Kleidon 1984:15). Thus, with the exception of Paintbrush House, the range of architectural features at the various sites is roughly similar.

All of the sites examined here except Paintbrush House have a formal midden. The lack of such a midden at Paintbrush House is additional evidence that the site represents an anticipated short occupation in contrast to the other sites, including Pinyon House (see below discussion of sampling error and archaeological inference).

Paintbrush House and Pinyon House kivas are similar to one another, but different from those at the other sites. Both are small and relatively shallow (approximately 80 cm below ground surface). Each has above-ground masonry walls. There is a general lack of remodeling in either kiva, which implies a short occupation, as noted by the excavators (e.g., Kuckelman 1984:30). The small size of the kiva also was used by the excavators as evidence of a seasonal occupation at Paintbrush House and Pinyon House (Kleidon 1984; Kuckelman 1984). Such an interpretation may be superficially supported by the ethnoarchaeological model where there is a strong correlation between anticipated length of occupation and size of domestic huts—seasonal occupations being shorter than year-round ones. However, the observation is not necessarily valid for religious structures, particularly those thought to be at least partially integrative in function.¹¹ We cannot assume a priori that kivas conform to the same variables that influence domestic dwelling size. I still consider Paintbrush House to have had a short occupation, but for reasons other than the size of the kiva. It may be argued that the larger site sizes and higher Pueblo II site density that existed outside the Dolores River area noted by Schlanger (1988) could account for the difference in kiva size, if size, in fact, reflects the number of people planning to use the structure.

Formal Storage Loci

Excavated pits are archaeologically visible evidence of formal storage areas (vs. informal storage [Kent 1992b]). Large, deep storage pits (in contrast to roasting pits, which imply food processing, not anticipated length of occupation) are located at all sites but Paintbrush House. Slab-lined pits indicate additional construction investment characteristic of anticipated long occupations. Gnatsville had, in addition to two slab-lined pits, a large unlined bell-shaped pit located in the rubble mound, for a total of three formal pits. Pinyon House had two pits. One was a slab-lined pit and the other was an unlined pit located on the kiva floor, which the excavator interpreted as a storage pit (Kuckelman 1984). One slab-lined pit and at least one large storage pit were associated with the Pueblo II occupation at Mustoe for a minimum total of two pits (Gould 1982). Probable storage pits were also uncovered at Badger House (Hayes and Lancaster 1975). Only one shallow slab-lined pit was uncovered at Paintbrush House by Kleidon (1984:18), but it is not, in my opinion, a storage

Table 2. Comparison of Diagnostic Ceramic Types.

Ceramic Type	Site				
	Gnatsville	Paintbrush	Pinyon	Mustoe ^a	Badger ^a
Chapin Gray	M	T	T	T	M
Mancos Gray	M	—	—	M	T
Mummy Lake Gray	T	—	T	T	—
Mancos Corrugated	A	T	—	H	H
Dolores Corrugated	T	T	A	—	—
Moccasin Gray	—	T	—	—	T
Dolores Brown	—	—	T	—	—
Abajo R/O	T	—	—	P	T
Bluff B/R	T	—	—	P	T
Deadmans B/R	T	—	—	—	T
Chapin B/W	—	—	—	—	T
Cortez B/W	M	—	—	M	M
Mancos B/W	H	M	M	A	A
McElmo B/W	T	—	T	—	T
Cibola Red Mesa B/W ^b	T	—	—	—	T
Escavada B/W ^b	T	—	—	—	—
Gallup B/W ^b	—	—	T	—	—
Puerco B/W ^b	—	—	—	—	T
Chuska ^b	—	—	—	—	—
Newcomb B/W	T	—	—	—	—
Kayenta Black ^b	—	—	—	—	—
Mesa B/W	T	—	—	—	—
Tusayan Polychrome ^b	—	—	—	—	T
Citadel Polychrome ^b	—	—	—	—	T
Wingate B/R ^b	—	—	—	—	T
Total number of sherds	3,475	419	721	—	—
Total number of types	15	5	7	8	16
Total number of sherds per type	231.7	83.8	103.0	—	—

Note: Dolores Archaeological Project terminology is used (see Blinman 1984; Blinman et al. 1984). Nondiagnostic sherds are not included in the percent categories. Sources: Kent (1991c); Kleidon (1984:56); Kuckelman (1984); Gould (1982:238–245); Hayes and Lancaster (1975:67). T = trace (5% or less by number or weight of the total diagnostic sherds identified); M = moderate (6–15% of the total diagnostic sherd assemblage); A = abundant (16–30% of the total diagnostic sherd assemblage); H = heavy (over 30% of the diagnostic sherd assemblage); P = present (present but number or percent of sherds not reported).

^a Only weights were reported and/or total Pueblo II assemblage lot count not given.

^b Nonlocal ceramic type.

pit since the sandstone lining is fire reddened. Roasting pits are not indicative of mobility but of subsistence or other activities. Other pits were identified at the site but were described as probable roasting pits, ash pits, or pits with unknown functions (Kleidon 1984). As far as can be deduced from the report, there were no formal storage pits at the Paintbrush House site, although the possibility of sampling error is always an uncontrollable factor.

Anticipated and Actual Occupation Length: Material Culture Abundance and Diversity

While the source of the vast majority of ceramic types at the sites is local to the immediate area, a few nonlocal diagnostic types occur at all sites except Paintbrush House and Mustoe (Table 2 lists the diagnostic types; only nondiagnostic exotic types were recovered from Paintbrush House). It is rather unusual that no exotic types were identified at the Mustoe site, but this may only be the result of sampling error (e.g., Rhode 1988) or that the trade sherds were not reported in Gould's (1982) dissertation, which was primarily concerned with local wares. Note in Table 2 that the three sites that are classified as anticipated long and actual long occupations according to the model—Gnatsville, Mustoe, and Badger House—also have the highest diversity, or in this case richness, of diagnostic ceramic types. These sites also have the largest number, or quantity, of sherds, and this

Table 3. Ceramic Sherds Located on Kiva Floor.

Ceramic Type	Site ^a			
	Gnatsville	Paintbrush	Pinyon	Badger
Chapin Gray	—	—	1	24
Mancos Gray	1	—	—	19
Mancos Corrugated	3	—	—	108
Dolores Corrugated	—	—	1	—
Moccasin Gray	—	—	—	1
Abajo R/O	—	—	—	2
Bluff B/R	—	—	—	1
Chapin B/W	—	—	—	1
Cortez B/W	4	—	—	15
Mancos B/W	18	3	4	71
Early Pueblo Gray	—	2	8	—
Late Pueblo Gray	1	—	—	—
Corrugated Body	65	1	34	243
Polished/sherd white	10	—	11	2
Unclassifiable	2	—	—	73
Total number of sherds	104	6	59	560
Total number of diagnostic types	4	1	3	9
Number of sherds per ceramic type	26	6	20	62

^a Sherds located on the kiva floor at the Mustoe site were not listed separately; therefore the site cannot be included in this table. Sources: Kent (1991c); Kleidon (1984:56); Kuckelman (1984); Hayes and Lancaster (1975:67).

needs to be taken into account when comparing the diversity of types. Even so, Pinyon House is followed by Paintbrush House with the lowest diversity and number of sherds (it is important to note that the same Dolores-Archaeological-Project-trained ceramic analysts identified the ceramics from Gnatsville and the two Dolores sites, factoring out potential variation stemming from different classification systems or gross differences in analysts' skills).

According to the model, anticipated and actual short occupations should have fewer artifacts and more homogeneous assemblages than anticipated or actual longer occupations. It has been suggested by a number of archaeologists that diversity may be a measure for actual length of occupation (F. Plog 1989; Reid 1982; Schlanger 1990; Thomas 1989; Yellen 1977).¹² The richness of the ceramic assemblage among sites is consistent with the model for an anticipated and actual short occupation for Paintbrush House but not for Pinyon House, which has more categories represented in addition to more nonlocal types (Table 2). Researchers have noted that sample size has a significant effect on the diversity of artifacts at a site (e.g., see McCartney and Glass 1990; papers by Thomas and others in the volume edited by Leonard and Jones [1989]). In order to take into account the discrepancy in absolute number of objects from the different sites, a rough abundance index was calculated for the different ceramic types (Table 2). To hold sample size constant, the total number of sherds from a site was divided by the total number of ceramic types (Table 2). Again, this calculation yielded numbers that were predicted by the model and the resulting interpretation of the sites. However, the difference is not large, which is why I consider Pinyon House an anticipated long but actual short occupation and why assemblage diversity might be more, or as, sensitive to actual mobility as it is to anticipated mobility.

Because of the effect of different excavation and collection strategies employed at the individual sites and because of the varying numbers of artifacts recovered, raw-number counts can be viewed only as a total number of sherds from each site and not by individual ware or type categories. In this case, the lowest number of sherds was from Paintbrush House, followed by Pinyon House, which also supports the other data and suggests an actual short occupation for Pinyon House but an anticipated long occupation. Even more persuasive is the variation in absolute number and

assemblage richness of sherds located on the kiva floor because (a) the same area and same kind of feature is being compared between sites, and (b) similar methods were used in excavation, collection, and analysis.¹³ At four of the five sites all artifacts located on the kiva floor were piece plotted (Table 3). As was the case with the ceramics from the entire site, the absolute number of sherds, the diversity of types, and the number of sherds per type on the kiva floor at Pinyon House were all more similar to Gnatsville and Badger House than to Paintbrush House. It is necessary to determine if assemblage diversity is more sensitive to actual mobility as abundance of cultural materials appears to be more sensitive to anticipated mobility (this represents one direction of my current studies at Kutse).

It is interesting that the two Dolores Archaeological Project sites lack Cortez Black-on-white ceramics, despite their archaeomagnetic dates, which place them at a time when Cortez Black-on-white was still being manufactured. In contrast, Cortez Black-on-white is present in the Gnatsville, Mustoe, and Badger House ceramic assemblages that cover the same time period as Paintbrush House and Pinyon House. It is possible that Cortez Black-on-white is partially correlated with mobility, at least by mid-Pueblo II, in that it is associated primarily with activities occurring in sedentary contexts. Its absence at Pinyon House may be due to what is interpreted here as an actual short occupation, although more research is needed to properly evaluate this suggestion.

A pattern similar to that observed for the ceramics occurs with the lithic artifacts (Table 4). Consistent with the model, Paintbrush House is the only site lacking nonlocal lithic raw material. All others, including Pinyon House, have some nonlocal raw material present. As was the case with the ceramics, and in order to take into account the disparity in absolute number of lithics from different sites, a rough abundance index was calculated based on the ratio of tool types present (see Table 4). The large ratio of tools to flakes at Paintbrush House indicates fewer lithic-reduction activities than occurred at either Gnatsville or Pinyon House. Even more illuminating is the percentage of tools in the total flaked-artifact inventory. Gnatsville has 9 percent tools (and 91 percent nonutilized flakes and angular debris), Pinyon House has 13 percent, and Paintbrush House has 29 percent, which is over double. More tools were brought already manufactured to Paintbrush House (where activities were probably more focused, being a specialized activity and/or seasonal camp) than was the case at Gnatsville or Pinyon House. Supporting this interpretation is the fact that hammerstones are more common at Gnatsville and Pinyon House than at Paintbrush House. It is significant, I think, that compared to Paintbrush House, Gnatsville and Pinyon House have almost four to five times the number of nonflaked, or ground-stone, lithic artifacts. These findings are consistent with a longer anticipated occupation.

The presence of ornamental objects at all sites but Paintbrush also supports the interpretation of the latter as a seasonal camp and the other sites as planned year-round occupations. Even if one were to claim that the absence of projectile points at Pinyon House is due only to the heavy vandalism of the rubble mound, such vandalism would not seriously influence the percentage of tools at the site. For example, based on the number of projectile points from the other nonvandalized sites, if vandalism did, in fact, cause the lack of projectile points, only a few projectile points would have been taken. Vandalism would not have significantly altered the tool/flake ratio nor the fact that Paintbrush House has a substantially higher tool/flake ratio than Pinyon House or any other site examined here.

The faunal and micro- and macrobotanical remains indicate that the inhabitants were procuring and processing a variety of resources at all sites except Paintbrush House. Plant processing as a seasonal activity focus (albeit not necessarily the grinding of maize or other domesticated plants) at Paintbrush House may be suggested by the fact that two out of the four identifiable ground-stone tools were manos and one was a metate fragment. However, based on such a small sample, this cannot be seen as conclusive in and of itself.

Faunal remains are more abundant at Gnatsville, Mustoe, and Badger House than at the other two sites (Table 5). Comparisons of assemblage richness *per se* among the sites need to be made cautiously because some species, such as rodents, are intrusive and because of differences in sample size among sites. Furthermore, especially for the smaller species, differences among sites may reflect screening and general excavation technique and sampling error more than any of the independent variables in the model. Therefore, for this analysis, it is probably better to be conservative and not

Table 4. Distribution of Flaked and Nonflaked Artifacts at Mesa Verde Anasazi Pueblo II Sites.

Lithic Artifact Type	Site				
	Gnatsville	Paint-brush	Pinyon	Mus-toe ^a	Bad-ger ^a
Flaked artifacts					
Nonutilized flake ^b	H	H	H	P	P
Tools					
Indeterminate tool	T	T	T	P	P
Utilized flake	H	H	H	P	P
Unused core	C	T	T	P	P
Used core	C	C	C		
Uniface "scraper"	A	T	C	P	P
Spokeshave	T	—	—	?	—
Denticulate	T	—	—	P	—
Graver/perforator/drill	T	—	—	?	P
Flaked axe	T	—	—	—	—
Biface "knife"	T	T	C	P	P
Projectile point	T	T	—	P	P
Specialized (ornamental) object	—	—	C	—	—
Ratio of total number of tools/nonutilized flakes	235/2,368	152/369	134/906		
Nonflaked tools					
Indeterminate, minimally altered, or unidentifiable	A	H	A	P	P
Polished/polishing stone	T	—	—	P	P
Abrading/grinding stone	C	—	—	P	P
Shaped stone slab	A	—	T	P	P
Hammerstone	A	T	A	P	P
Mano	C	C	A	P	P
Metate	—	T	T	P	P
Ornament fragment	C	—	—	P	P
Geometric shaped pendant	C	—	—	P	P
Paint pestle	—	—	—	—	P
Maul	—	—	—	P	P
Axe	—	—	—	P	P
Whetstone	—	—	—	—	P
Total number of nonflaked tools	54	11	42		

Note: Sources: Kent (1991d); Kleidon (1984:47–56); Kuckelman (1984:46–53); Gould (1982); Hayes and Lancaster (1975). T = trace (5% or less by number or weight of the total either nonflaked- or flaked-tool assemblage identified); C = common (6–15% of the total either nonflaked- or flaked-tool assemblage); A = abundant (16–30% of the total either nonflaked- or flaked-tool assemblage); H = heavy (over 30% of the either nonflaked- or flaked-tool assemblage); and P = present (present but number or percent of nonflaked or flaked tools not reported).

^a Totals were not reported.

^b Note that nonutilized flakes were compared to the total lithic inventory. Also note that all components were included for the Badger House list, which may account for some of the discrepancy in the type of artifacts recovered from that site.

discuss species richness at the sites. Nonetheless, the presence/absence of larger animal species, such as turkey, can be productively examined among the sites. This is particularly the case with a domesticate that, in theory, would be available year-round, if a camp were occupied year-round.

The lack of turkey at the Dolores River valley sites might be a result of actual short occupations, planned or otherwise (Table 5). One would expect to find turkeys at anticipated year-round sites but not at seasonal sites. People might be more likely to leave turkeys at a year-round base camp than to transport them to a seasonal or anticipated short occupation camp.¹⁴ The presence of turkey remains may also be related to actual length of occupation since there would be a greater chance of people consuming a turkey, and therefore having their bones in the faunal assemblage, at a site occupied for a long time than at a site occupied for a short time. The absence of turkey bones at

Table 5. Comparison of Faunal Species Represented.

Species Identification	Site			
	Gnatsville	Paintbrush	Pinyon	Mustoe ^a
<i>Bison bison</i> (bison)	—	—	—	R
<i>Canis</i> sp. (probable dog)	R	—	—	—
<i>Castor</i> sp. (beaver)	—	—	—	R
<i>Cervus canadensis</i> (elk)	—	—	—	C
<i>Cynomys gunnisoni</i> (prairie dog)	R	—	—	R
<i>Dipodomys ordii</i> (Ord's kangaroo rat)	R	—	—	—
<i>Dipodomys spectabilis</i> (banner-tailed kangaroo rat)	A	—	—	—
<i>Erethizon dorsatum</i> (porcupine)	—	—	—	R
<i>Lepus californicus</i> (jack rabbit)	C	C	—	R
<i>Meleagris gallopavo</i> (turkey)	C	—	—	H
<i>Neotoma albigula</i> (woodrat)	R	—	—	—
<i>Odocoileus</i> sp. (mule deer)	—	—	—	A
<i>Spermophilus variegatus</i> (squirrel)	R	C	—	—
<i>Sylvilagus auduboni</i> (cottontail)	A	—	R	—
<i>Thomomys bottae</i> (pocket gopher)	R	R	R	—
<i>Vulpes vulpes</i> (red fox)	—	—	—	R
Total number of bones	176	20	31	173

Note: Sources: Kent (1991c); Kleidon (1984:56); Kuckelman (1984); Gould (1985:238–245). R = rare (5% or less of the total NISP); C = common (6–15% of the total NISP); A = abundant (16–30% of the total NISP); H = heavy (over 30% of the total NISP).

^a Only the Pueblo II component fauna are included.

Pinyon House and Paintbrush House is consistent with my interpretation of them as representing actual short occupations.

Differences in the macrobotanical remains might simply reflect the more mesic environment of the Dolores River valley compared to the uplands where Gnatsville is located. This is particularly true concerning the diversity of species of trees at the Dolores sites (Table 6). Another problem in viewing species richness among sites is that samples of macrobotanical remains were not taken from the rubble mound at Pinyon House. Furthermore, because of funding constraints, only a portion of the flotation samples collected were analyzed from Gnatsville. These did not include any samples from the midden. As a result, comparing species richness among sites is not appropriate with these data. It may be more appropriate to compare species that Gnatsville shares with one of the Dolores sites but not with the other, than to compare both Dolores sites' floral assemblages with the one from Gnatsville. It is interesting that Gnatsville and Pinyon House have juniper while Paintbrush House does not and that Paintbrush House and Gnatsville have pine but that Pinyon House, in spite of its name, does not. Whereas we can postulate that a short occupation is the reason Paintbrush House lacks juniper, it is more difficult to interpret the lack of pine at Pinyon House. One problem and possible explanation is that botanical samples were not obtained from the rubble mound at Pinyon House (however, neither were any samples analyzed from the rubble mound at Paintbrush House, if one exists).

Despite all these cautions, some general inferences are possible from site comparisons. Gnatsville can be used as a baseline from which to compare the other sites because it probably provides the best indication of the frequency and diversity of faunal and botanical species present at short-term sedentary Pueblo II camps where inhabitants anticipated and actually had a long occupation. Using the model, and given the differences between Paintbrush House and the other sites, it appears that Paintbrush House was an anticipated and actual short occupation. Gnatsville, Mustoe, and Badger House consistently resemble each other more than they resemble Pinyon House or Paintbrush House. Pinyon House consistently falls in between Paintbrush House and the other sites that represent anticipated and actual long occupations.

Table 6. Comparison of Identifiable Flora from Macrobotanical Samples.

Species Identification	Site		
	Gnatsville	Paintbrush	Pinyon
<i>Amaranthus</i> (pigweed)	X	X	X
<i>Amelanchier</i> (serviceberry)	—	X	—
<i>Artemisia</i> (sagebrush)	—	X	—
<i>Boehmeria</i> sp.	X	—	—
<i>Cercocarpus</i> sp. (mountain mahogany)	—	X	X
<i>Chenopodium</i> sp. (goosefoot)	X	X	X
<i>Cleome</i> sp. (beeweed)	X	—	—
<i>Echinocereus</i> sp. (hedgehog cactus)	X	—	—
<i>Juniperus</i> sp. (juniper)	X	—	X
<i>Nicotiana attenuata</i> (wild tobacco)	—	—	X
<i>Opuntia polycantha</i> (prickly pear)	X	—	—
<i>Oryzopsis</i> sp. (rice grass)	X	—	—
<i>Physalis</i> sp. (ground cherry)	X	—	X
<i>Pinus edulis</i> (pinyon)	X	X	—
<i>Polygonum</i> sp. (knotweed)	—	X	—
<i>Portulaca</i> sp. (purslane)	X	X	—
<i>Quercus</i> sp. (oak)	—	X	X
<i>Populus</i> sp. (poplar)	—	X	X
<i>Yucca</i> sp.	—	X	—
<i>Zea mays</i> (maize)	X	X	X

Note: Sources: Kent (1991d); Kleidon (1984:56); Kuckelman (1984). X = present.

DISCUSSION

For a thorough understanding of the prehistory of an area, it is essential to be able to distinguish different lengths of occupations, particularly in a region such as the Southwest where mobility patterns fluctuated through time (e.g., Cordell 1984; Kohler and Matthews 1988; Powell 1990; Schlanger 1988). Archaeologists throughout the Southwest (Dohm 1988; Scarborough 1989; Schlanger 1991) and elsewhere are grappling with the problem of identifying site duration (e.g., Great Basin [Simms and Heath 1990]; American Bottom, Illinois [Pauketat 1989]; also see Kintigh [1989]). To elucidate relations between mobility and site structure, we need to use ethnoarchaeological models that are cross-cultural and therefore cross-temporal and applicable to the archaeological record on any continent (such ethnoarchaeological studies include Binford [1982]; Fisher [1986]; O'Connell [1987]; and Yellen [1977]). Otherwise, we are forced to rely on ethnographic analogy that describes a single culture at a specific period and is appropriate only to that culture during that time, which is our other alternative (e.g., Kent 1987; Rocek 1988).

A number of different indexes have been suggested as measurements of site duration, particularly with reference to seasonal, in contrast to year-round, occupations (e.g., Bar-Yosef and Belfer-Cohen 1989; Gilman 1987; Mills 1989; Wills and Windes 1989). The model of mobility presented here attempts to recognize variability in intragroup mobility patterns and then link it to variability in the archaeological record. My research indicates that in most cases anticipated mobility explains more variance and is a stronger predictor of various facets of site structure and artifact assemblages than the other variables monitored. The model is a lower-level theoretical construction based on a view of anticipated mobility as structuring site patterning. Understanding what structures anticipated mobility represents a higher level of theoretical modeling that is necessary before we can completely understand intragroup site variability.¹⁵ Therefore, this and my previous studies represent only the first step in the long road to understanding intersite variability.

Whereas it could be argued that some assemblage variability can be attributed to the multicom-

		<u>Anticipated Occupation</u>	
		Short	Long
<u>Actual Occupation</u>	Short	Paintbrush House	Pinyon House
	Long		Gnatsville Mustoe Site Badger House

Figure 2. Application of the ethnoarchaeological model to five Pueblo II sites.

ponent nature of Badger House and Mustoe in contrast with the single-component Pinyon House and Paintbrush House, this is not the case with Gnatsville, which is also a single-component site. Something else must account for the differences between Gnatsville and the Dolores River valley sites. Paintbrush House was clearly a seasonal camp, perhaps one that had been reused (planned reoccupation could account for the kiva). Badger House, Mustoe, and Gnatsville were clearly year-round habitations. Most ambiguous, yet informative in terms of our understanding of regional mobility patterns, is Pinyon House. Its size, architecture, and site structure, including a slab-lined pit and a formal midden, suggest short-term sedentism, i.e., year-round occupation, similar to Gnatsville (Table 7). The ratio of tools to nonutilized flakes also implies sedentism, although to a lesser degree. However, the kinds of objects and absolute number of ceramics, lithics, and faunal and botanical remains all suggest a shorter actual occupation than would be consistent with most sedentary camps, though an anticipated longer one than that for Paintbrush House. Pinyon House was probably an anticipated year-round site that was occupied for only a season or less (Figure 2). I have attempted to demonstrate that the two are not necessarily mutually exclusive—there are camps reported in Kent and Vierich (1989) where occupants planned one thing and actually did another.

If Pinyon House were an anticipated short occupation, why would inhabitants bother to dispose of trash at a formal locus such as a midden? If Pinyon House and Paintbrush House represent the same anticipated and actual short occupations, how can we account for the similarities among Pinyon House and Gnatsville, Mustoe, and Badger House, despite the longer occupations at the latter sites? And then how do we explain the dissimilarities between Pinyon House and the seasonal occupation of Paintbrush House? If Pinyon House represents the same anticipated short occupation

Table 7. Summary of Contrasts Among Sites.

	Gnatsville	Mustoe	Badger	Pinyon	Paintbrush
Architecture	kiva and rooms	kiva and rooms	kiva and rooms	kiva and rooms	kiva and rooms?
Midden	yes	yes	yes	yes	none
Site size (sq m)	3,600	?	?	45,000	1,008
Formal storage loci	storage pits	storage pits	storage pits	storage pits	none
Nonlocal identifiable ceramic types	yes	?	yes	yes	no
Cortez B/W	yes	yes	yes	no	no
Nonlocal lithic raw material present	yes	yes	yes	yes	no
Lithic ornamental object(s) present	yes	yes	yes	yes	no
Percent of tools in flaked lithic assemblage (remainder is unmodified flakes)	9%	?	?	13%	29%
Turkey remains	yes	yes	yes	no	no

as Paintbrush House, how do we explain the absence of storage pits and middens at Paintbrush House but their presence at Pinyon House? Attributing all differences to sampling error, (e.g., the absence of a midden and storage pits at Paintbrush House) is not a very productive way to view the archaeological record in my opinion. To do so would create an untestable situation that makes one's hypotheses unrefutable—e.g., an interpretation is always correct regardless of the data because when items that should be present to validate the interpretation are not, their absence is simply explained away by sampling error. If future research at Paintbrush House reveals storage pits and a midden, then my interpretations of the site will need to be modified. However, I think it would be unwise to assume *a priori* that such features are present but have not yet been uncovered making my interpretations false or, at best, unverifiable. While no single attribute discussed here demonstrates the anticipated and actual length of site occupation at Pinyon House, together the data suggest an anticipated long but actual short stay. This view then raises a number of interesting questions.

It has been suggested that the Dolores River valley was only seasonally occupied during the mid-Pueblo II period (Kane and Gross 1986). This does appear to be the case with Paintbrush House. Pinyon House, on the other hand, is quite different. According to most investigators (e.g., Kane and Gross 1986), the majority of sites in the area appear to be planned short-seasonal habitations. Perhaps occupants at Pinyon House attempted a year-round occupation but could not, or did not want to, stay for whatever reason(s). There may have been diversity in the settlement pattern during this time period. Some people might have resided permanently along the Dolores River in very small family camps while others lived in aggregated communities elsewhere and seasonally visited the Dolores River area to exploit its resources. We need to test for a variety of residence patterns before excluding the possibility of any single one. The model discussed here is one way we can begin to examine the amount of diversity present in regional settlement patterns. Once that diversity is known, we can begin to formulate models to explain it.

Seasonal camps can be the result of two very different mobility patterns. One is a sedentary pattern wherein a site is one of many used seasonally for a short period over time. The second is a sedentary pattern wherein groups seasonally go to the same special activity sites to exploit specific resources, resulting in site reoccupation. The two patterns might be difficult to distinguish because preliminary data indicate that some attributes of anticipated reoccupation of planned short-term habitations may resemble sites of anticipated longer habitations (Kent and Vierich 1989). Clearly, more research is called for to explore this important facet of the model and the impact of anticipated site reoccupation on artifact and faunal assemblages and site structures (e.g., Tomka 1993).

Studying settlement patterns in two areas might require that the range of variation in mobility patterns in each region be ascertained before cross-cultural comparisons can be made. Using the model described here, one can contrast areas across space, such as between Mesa Verde and Chacoan Anasazi; through time, such as increasing sedentism of the Natufians in the Levant (Bar-Yosef and Belfer-Cohen 1989); or within a region, such as the increasing mobility that occurred during different periods in the Southwest (Euler 1988). Other examples of potential application of the model are the study of variation in site structure and artifact assemblages between ecological zones within the same region (e.g., Byrd [1989] for coastal and steppe Natufian sites in Jordan) or within political and social hierarchies that were expressed in settlement patterns and perhaps mobility (e.g., Pauketat [1989] for Lohmann and Stirling phase sites on the American Bottom, Illinois). If anticipated length of stay influences site structure and material culture as is suggested here, then we might see increasing numbers of miscalculations (i.e., anticipated long, but actual short, occupations) during intervals of unpredictability just before the abandonment of regions as occurred in various parts of, and at various times in, southwestern prehistory.¹⁶

Because the model is comparative in nature, there are no absolutes. All other factors being equal (e.g., no geographical constraints in one area that are not present in another), longer anticipated occupations should have larger hut diameters, formal storage facilities, larger total site area, etc. This should be the case whether one compares camps in two different areas or camps within the same region. Because the same processes are thought to underlie the relation between mobility patterns and site structure on both the cross-cultural and intragroup levels, we should expect similar relations to be valid when ascertaining the settlement patterns of various types of sedentary vs.

nomadic groups. Therefore, the model should also be useful when comparing groups from different regions that practiced different types of nomadism or sedentism.

While more research is necessary to work out all the details of the model (e.g., do the relations remain constant in large aggregated villages?) this article represents a beginning to which more data and sites can be added. For example, it would be interesting to apply the model to the variability noted by Pauketat (1989) at Mississippian sites, by Filios (1990) at hunter-gatherer sites in southern New England, or by Byrd (1989) at sites in the Levant (also see Sullivan 1992). It is hoped that researchers in these areas, as well as in others, will be persuaded enough by the arguments presented here to attempt to operationalize the model for their data and perhaps refine it so that the model is more applicable to a variety of artifact analyses and sites. Whereas the model can explain cross-cultural and intragroup variability on the basis of different anticipated lengths of occupation, a robust theory is still needed to understand which factors structure the anticipated length of occupations—this is the goal of future research.

CONCLUSIONS

The ethnoarchaeological model of mobility attempts to account for some of the intragroup site variability present in most regions. The model is also applicable to asking questions about differences in cross-cultural mobility patterns, such as differences between site structure and artifact assemblages associated with various types of nomadism and sedentism. With the exception of the number of huts present, anticipated mobility is consistently a significant and stronger predictor of the dependent variables monitored than are the other independent variables tested here. By delineating variability we can better understand how groups across space and through time differed from one another and why. Hopefully, the ethnoarchaeological model of mobility presented above will be one step in that direction.

I used the southwestern data base I know best as a demonstration of the model to illustrate its application to the archaeological record. I hope that archaeologists working in other areas will find the model and the delineation of intragroup mobility patterns interesting enough to refine it and apply it to their data and/or to collect the relevant data necessary to apply the model to a variety of groups of various time periods in different regions around the world.

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NOTES

¹ Elsewhere I used the terms “short,” “medium,” and “long mobility” to designate the length of time occupants planned to stay at a camp and the length of time they actually did spend at a camp when referring to mobility patterns on both the cross-cultural and intragroup levels (Kent 1991a; Kent and Vierich 1989). Unfortunately, this usage was confusing as was justifiably noted by Preucel (1991). I attempt to keep the two levels distinct in this paper, and the discussion provided herein hopefully clarifies the terminology and its application to the archaeological record.

² Hitchcock (1987:395–396) has noted the increase in formal storage facilities at sedentary in contrast to nomadic Basarwa camps to the northeast of the study area from which the model was derived. However, he attributes the increase to the adoption of horticulture. In this case it is difficult to separate the adoption of horticulture from the length of habitation, since farming tends to be strongly associated with anticipated long occupations. Both my data from Kutse and Vierich’s data from Ngware include sedentary hunter-gatherers, in addition to sedentary horticulturists, who have anticipated long occupations. These data instead suggest that the presence of formal storage is not a consequence of horticulture, but is more directly the result of sedentism and anticipated long occupations and the accumulation of goods that accompanies them (Kent 1992b; Kent and Vierich 1989).

³ The only exceptions were the Ngware fenced sites where an arbitrary 1.5 m beyond the fence was included (Kent and Vierich 1989). However, ethnographic observations, according to Vierich, indicate that these measurements usually correspond to Yellen’s (1977) LMS measurement. The size measurements of nonfenced sites are directly comparable to the LMS measurement.

⁴ For example, although perhaps not for reasons appropriate to all societies, there is a strong relation between the absolute number of objects at transhumant agropastoralists’s sites from Bolivia and the length of abandonment ($p = .001$; Tomka 1993).

⁵ Several anonymous reviewers of this manuscript complained that the R^2 for anticipated mobility ranges from .234 to .509 and therefore “only” explains 23 to 51 percent of the variation (Table 1). However, statisticians have noted that “Whether a given R^2 value is considered to be large or small depends on the context of the particular study. A social scientist might consider an R^2 of .30 to be large, while a physicist might consider .98 to be small . . . If you fit many different models and choose the model with the largest R^2 , all the statistics are biased and the p values for the parameter estimates are not valid” (SAS 1990:15; emphasis added). The reason is that there is less variation possible in physical forces than in human behavior, which is known to be variable. Therefore, if one is measuring characteristics of ceramic vessels, a R^2 of .23 is probably rather low in terms of the variance it explains. However, the model presented here is concerned with human behavior wherein the same R^2 can be considered satisfactory. Moreover, “a sizable R^2 does not necessarily mean we have a causal explanation for the dependent variable; instead, we may merely have provided a statistical explanation [i.e., a spurious correlation]” (Lewis-Beck 1990:24; emphasis in original). Therefore, a strong theory must accompany the statistical analysis wherein a significant F test and a R^2 of .234 can be considered to have much explanatory usefulness.

⁶ The square-meters-per-person measurement is the total number of square meters of a camp divided by the number of occupants.

⁷ Arnold (1990) and Hayden and Cannon (1983) note the use of formal trash areas at sedentary habitations in Mesoamerica (these authors suggest midden distance from a dwelling varies due to compound size and intensity of activities at a given locus). Although Fisher and Strickland (1989:477) state that Pygmies use trash

heaps, it is obvious from their drawings of camps that such heaps are not formal refuse areas but are merely informal accumulations of trash around the periphery of a hut or camp, as is predicted by the model (also see Fisher 1986).

⁸ Note that tests for the different assumptions, including the absence of multicollinearity, were run to ensure that, for example in the latter case, none of the variables were highly intercorrelated, particularly anticipated mobility, actual mobility, and type.

⁹ The only other Pueblo II site reported by the Dolores Archaeological Project is dated as late Pueblo II–early Pueblo III, which would place it chronologically a little later than the sites described here (Harriman 1983). Therefore, the Sundance Hamlet site was not included. Other mid-Pueblo II sites in the region either did not have the data reported in such a manner as to make the comparisons needed to apply the model, or else the sites were multicomponent with a mixing of data that made it difficult to distinguish objects and features from the different components.

¹⁰ Dendrochronologic outside dates from the kiva were: A.D. 959 +vv, 991 +vv, 1006 +vv, 1014 +vv, and 1034 +r; from midden 2: 913vv and 1023vv; and from the rubble mound: 1035 +r and 1028v. The dates suggest a building phase shortly after A.D. 1035 (William J. Robinson, personal communication 1984).

¹¹ Although the possibility that kivas may not be primarily religious, social, and/or integrative in function has been raised, e.g., Lekson (1988, 1989), most archaeologists still accord the structures specialized functions along those lines, e.g., Adler (1989), Hegmon (1989), Lipe (1989), S. Plog (1989), Wilshusen (1986, 1989).

¹² Diversity is a term commonly used to describe variability. Recently, however, diversity has been given a highly specific and technical definition that is useful when dealing with quantitative data (see Jones and Leonard 1989:2). In this paper, diversity refers to richness or the number of categories rather than to evenness, or the extent to which categories are represented by similar quantities of objects and range, or to the amount of difference between the most divergent categories (as defined by Cowgill [1989]). All are components of diversity, but because of the nature of comparative studies wherein data are not reported in analogous ways, evenness and range cannot be determined here.

¹³ Only a sample of the kiva at Gnatsville was excavated; the number and diversity of sherds would probably have resembled those from Badger House, had time permitted the excavation of the entire pit structure. In other words, the trend of more objects and greater diversity of objects at anticipated long occupations is still visible at Gnatsville, despite the fact that the entire kiva floor assemblage was not uncovered.

¹⁴ Tarahumara, however, occasionally take turkeys with them to seasonal camps if there is no one to watch them at the base camp (Martha Graham, personal communication 1989).

¹⁵ Understanding anticipated mobility is the focus of my current research project in the Kalahari and that of others.

¹⁶ Therefore, the archaeological record may contain more “errors” wherein anticipated mobility and actual mobility do not coincide (G. Tom Jones, personal communication 1991). We might expect this to occur more frequently during times of stress, be it from the perspective of sociopolitical uncertainty and upheaval or from the perspective of unreliable resource availability.

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